

2000 IEEE Aerospace Conference: Abstract

From Order to Flight in one Year: Sensor Delivery Experience

M. Buehler

Microdevices Laboratory

Jet Propulsion Laboratory

California Institute of Technology

Pasadena, CA 91109

In the course of developing numerous small space instruments and sensors a number of rules and procedures have been uncovered that allow their low-cost, rapid development. This paper identifies the keys to rapid development and illustrates their application to space flight deliveries for Clementine, STRV-1b, STRV-1d, and MECA.

A. Technical Factors:

1. Design and Simulation:

- Design by analogy: (Find commercial solutions and adapt to space conditions.)
- Use CAD to evaluate performance: (Sensors are a marriage of electrical and mechanical arts.)
- Develop simple analytical models to predict behavior: (Allows big picture view.)
- Deliver sensor with integral data acquisition system. (Don't deliver a stand-alone sensor.)
- Use multisensors for different materials (eliminates mechanisms)
- Use multisensors in place of auto scaling (One sensor is sensitive; another is insensitive.)

2. Fabrication: Use proven standard processes: (Innovate in X and Y not in Z.)

- Use conservative design rules: (Overdesign where possible.)
- Review process steps intensively: (Identify miracles/risks and develop alternative solutions.)
- Make many prototypes: (This facilitates parallel testing and speeds fault finding.)

3. Parts: Use COTS.

- In House: Remove procurement impediments via credit cards
- External: Use over night part suppliers
- COTS means part may have to be qualified.
- At the outset of the project, verify that parts satisfy operating/survival conditions.

4. Test/Calibration:

- Engage as many people as possible in the testing activity to speed fault finding.
- Plan calibration as an up front integral part of the effort.

B. Organizational Factors:

1. Technical Expertise

- Utilize a small dedicated group of expertise: (Everyone must be prepared to work many hours.)
- Be prepared to work on project intermittently: (Document so you can restart job quickly.)

2. Management

- Work ahead of the schedule: (If job is done, descope is less likely.)
- Communicate requirements as soon as possible.
- Work closely with fabricators to ensure a quality job: (Very important for unique sensors.)